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EXAMINER

HUYNH, ANDY

ART UNIT PAPER NUMBER

2818

DATE MAILED: 06/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/652,430

Applicant(s)

SUR ET AL.

Examiner

Andy Huynh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-23 and 31-59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 and 31-59 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

In Request For Continued Examination (RCE) dated June 2, 2003, with the Amendment C dated April 11, 2003, in Paper No. 10, Applicants have amended claims **1, 8, 17, 21, 45 and 55** is acknowledged. Accordingly, claims **1-23 and 31-59** remain pending in the application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims **1-3, 6-10, 13-23 and 31-59** are rejected under 35 U.S.C. 103(a) as being unpatentable over Daves et al. (USP: 6,091,603), Applicants' submitted prior art, in view of Edwards et al. (USP: 6,294,408).

Regarding claim **1**, Daves et al. disclose in Fig. 2 an assembly comprising:

a die 600 having a surface;

an adhesion layer 200 coupled to the surface;

a solder-wettable layer 104 coupled to the adhesion layer;

a lid 101; and

a solderable thermally conductive element 103 to couple the lid to the solder-wettable layer (column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

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However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Regarding claim **2**, Daves et al. disclose the assembly recited in claim 1 wherein the lid comprises material from the group consisting of copper and aluminum-silicon-carbide as claimed in claim 2 (col. 4, line 23).

Regarding claims **3, 13, 19, 22, 50 and 56**, Daves et al. disclose the assembly recited in claims 1 and 55, the integrated circuit package recited in claim 8, the electronic assembly recited in claim 17 and the electronic system recited in claim 21 wherein the solderable thermally conductive element comprises material, including one or more alloys, from the group consisting of tin, bismuth, silver, indium, and lead (col. 5, lines 7-9).

Regarding claims **6-7, 15-16, 41, 43 and 52**, Daves et al. and Edwards et al. disclose the claimed invention except for the assembly recited in claims 1 and 45, the electronic assembly recited in claim 17, and the electronic system recited in claim 21 and further comprising: a diffusion layer between the adhesion layer and the solder-wettable layer. It would have been an obvious matter of design choice to form a diffusion layer between the adhesion layer and the solder-wettable layer, since applicant has disclosed in the specification, page 7, lines 29-30 that

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the diffusion layer is not necessarily required, depending upon the composition of the adhesion layer and it appears that the invention would perform equally well without the diffusion layer.

Regarding claim 8, Daves et al. disclose in Fig. 2 an integrated circuit package comprising:

- a substrate 500;

- a die 600 positioned on a surface of the substrate, the die having a back surface;

- an adhesion layer 200 formed on the back surface;

- a solder-wettable layer 104 formed on the adhesion layer;

- a lid 101 positioned over the die; and

- a solderable thermally conductive element 103 coupling the solder-wettable layer and the lid (column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Regarding claims 9 and 18, Daves et al. disclose in Fig. 2 the integrated circuit package recited in claim 8 and the electronic assembly recited in claim 17 wherein the lid comprises a support member 102 coupled to the substrate.

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Regarding claim **10**, Daves et al. disclose the integrated circuit package recited in claim 8 wherein the lid comprises material from the group consisting of copper and aluminum-silicon-carbide (col. 4, lines 17-24).

Regarding claims **14 and 20**, Daves et al. disclose in Fig. 2 the integrated circuit package recited in claim 8 and the electronic assembly recited in claim 17 wherein the substrate is an organic substrate 500 and wherein the die is coupled to the substrate through a land grid array 650 (col. 6, lines 1-14).

Regarding claim **17**, Daves et al. disclose an electronic assembly (col. 1, lines 65-66) comprising:

at least one integrated circuit package (col. 1, line 66) in Fig. 2 comprising:

a substrate 500;

a die 600 positioned on a surface of the substrate, the die having a back surface

an adhesion layer 200 formed on the back surface;

a solder-wettable layer 104 formed on the adhesion layer;

a lid 101 positioned over the die; and

a solderable thermally conductive element 103 coupling the solder-wettable layer and the lid (column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

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It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Regarding claim **21**, Daves et al. disclose an electronic system comprising an electronic assembly (col. 1, lines 65-66) having at least one integrated circuit package (col. 1, line 66) in Fig. 2 comprising:

- a substrate 500;
- a die 600 positioned on a surface of the substrate, the die having a back surface;
- an adhesion layer 200 formed on the back surface;
- a solder-wettable layer 104 formed on the adhesion layer;
- a lid 101 positioned over the die; and
- a solderable thermally conductive element 103 coupling the solder-wettable layer and the lid (column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Regarding claim **23**, Daves et al. disclose the electronic system recited in claim 21 wherein the substrate is an organic substrate 500, wherein the die is coupled to the substrate through a land grid array 650 (col. 6, lines 1-14), and wherein the lid comprises a support member 102 coupled to the substrate (Fig. 2).

Regarding claims **31-33, 40, 51, and 57-59**, Daves et al. and Edwards et al. disclose the claimed invention except for the assembly recited in claims 1, 45, and 55 and the integrated circuit package recited in claim 8 wherein the solderable thermally conductive element has a liquidus temperature of 150 degrees Centigrade or less; or a liquidus temperature of 140 degrees Centigrade or less; or a liquidus temperature in the range of 138 to 157 degrees Centigrade. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to obtain the solderable thermally conductive element has a liquidus temperature as stated above, since it was known in the art that the solderable thermally conductive element having a liquidus temperature in the range of 138 to 157 degrees Centigrade is commercially available from Indium Corporation of America, Utica, NY (Specification, page 8, lines 17-19).

Regarding claims **34-39, 42, 44, 46-49 and 53-54**, Daves et al. and Edwards et al. disclose the claimed invention except for the assembly recited in claims 1, 6, 45 and 52, the electronic assembly recited in claims 41 and 43 wherein the adhesion layer or the solder-wettable layer or the diffusion layer or the layers comprises material, including one or more alloys, from the group consisting of titanium, chromium, zirconium, nickel, vanadium, and gold; wherein the adhesion layer comprises titanium; wherein the solder-wettable layer comprises one of nickel and gold; and the diffusion layer comprises nickel-vanadium. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the adhesion layer

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or the solder-wettable layer comprises material, including one or more alloys, from the group consisting of titanium, chromium, zirconium, nickel, vanadium, and gold, the solder-wettable layer comprises one of nickel and gold, and the diffusion layer comprises nickel-vanadium, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claim **45**, Daves et al. disclose in Fig. 2 an assembly comprising:

a die having a surface 600;

an adhesion layer 200 formed on the surface; and

a solder-wettable layer 104 formed on the adhesion layer to receive a solderable thermally conductive element 103 (column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Regarding claim **55**, Daves et al. disclose in Fig. 2 an assembly comprising:

a die having a surface 600;

an adhesion layer 200 coupled to the surface;

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a solder-wettable layer 104 coupled to the adhesion layer;
a lid 101; and
a thermal interface of solder material 103 to couple the lid to the solder-wettable layer
(column 4, line 16-column 6, line 18).

Daves fails to teach an adhesion layer of metal.

However, Edwards teaches in Fig. 2 an electronic chip assembly comprising a metal thermal interface material (19) is used between chip device (16) and lid (20) as set forth in column 7, lines 6-9.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to utilize a metal thermal interface material between chip device and lid, as taught by Edwards to form the claimed invention in order to enhance the thermal conductivity of the adhesive layer.

Claims **4-5 and 11-12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Daves et al. (USP: 6,091,603), Applicants' submitted prior art, in view of Edwards et al. (USP: 6,294,408), and further in view of Patel (USP: 5,396,403).

Regarding claims **4, 11**, Daves et al. and Edwards et al. disclose the claimed invention except for the assembly recited in claims 1 and 8 wherein the lid comprises at least one metal or organic layer to which the thermally conductive element can be coupled. However, Patel teaches in Fig. 1 that the thermal paste comprising metal or the like is used as the second thermal interface 25 between the thermally conductive plate 19 and the heat sink 23 (col. 4, line 42 -col. 5, line 8). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to form the lid comprises at least one metal such as the thermal paste

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comprising metal or organic layer to which the thermally conductive element can be coupled, as taught by Patel in order to conduct the heat from the plate as the thermally conductive element to the lid as the heat sink (col. 3, lines 29-31).

Regarding claims **5 and 12**, Daves et al., Edwards et al. and Patel disclose the claimed invention except for the assembly recited in claims 4 and 11 wherein the at least one metal or organic layer comprises nickel or gold. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to utilize nickel or gold to form the at least one metal or organic layer, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Takahashi et al. (USP: 6,372,337), Daves et al. (USP: 6,292,369), Toy et al. (USP: 6,218,730), Iruvanti et al. (USP: 5,098,609), and Voss (USP: 4,827,376) are cited as of interest.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andy Huynh, (703) 305-0089. The examiner can normally be reached on Monday-Friday from 8:30 AM to 5:00 PM. The examiner's supervisor, David Nelms

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can be reached on (703) 308-4910. The Fax number for the organization where this application or proceeding is assigned is (703) 308-7724. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose phone number is (703) 308-0956.



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PRIMARY EXAMINER